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- 1 "Estimated Average Prevailing Dust Concentrations."  
2 Q Does Dr. McDonald prevent -- present any variability,  
3 standard deviation, or confidence interval for the exposure  
4 numbers?  
5 A No.  
6 Q Is that standard?  
7 A Yes.  
8 Q Okay. I think you said that -- you had talked about the  
9 industry, the job, and then the product, and the use of the  
10 product.  
11 A That's correct.  
12 MR. McMILLAN: Can we look at GG-2207? I want to  
13 talk now about the product.  
14 Q Now, for spray fireproofing are there different types of  
15 products that might be used?  
16 A Yes, for spray fireproofing there are two major types or  
17 categories of spray fireproofing, a wet type and a dry type.  
18 Q Do those two types have different compositions?  
19 A There's a difference in composition in terms of the  
20 asbestos content, yes.  
21 Q Are they used or applied in different ways?  
22 A The application methods are very different, yes.  
23 Q Now, what you can see on GG-2207 is an excerpt from an  
24 article by Dr. Reitze. Are you familiar with this article?  
25 A Yes, I am.

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1 Q And what is Dr. Reitze explaining in the part we have  
2 excerpted here?

3 A Well, in the excerpt he briefly and succinctly describes  
4 the difference between the way in which the dry fireproofing  
5 and the wet fireproofing are installed in a building, if you  
6 will.

7 Q Can you explain that to us?

8 A I'll try to be as brief. Basically, the dry type  
9 insulation -- I'll try this again. The dry type installation  
10 of fireproofing involves the mixing of the asbestos fibers and  
11 the binders which could be -- they're basically plasters or  
12 cements. They're mixed dry and then conveyed under air -- high  
13 air pressure through a hose to the site of application. The  
14 dry material emerges from the hose under this high air  
15 pressure, is blown out, and simultaneously there's a spray of  
16 water that is sprayed into this dry dust cloud. The mixing,  
17 such as it is, occurs there, and the wet -- the wetted material  
18 would stick to the steel or the ceiling or whatever.

19 On the other hand, the -- in the wet application  
20 method the asbestos-containing materials and the binders are  
21 mixed with water in what is a cement mixer or a small hand  
22 cement mixer, and they are conveyed through the --- this hose  
23 as a wet slurry. Okay. It's kind of a wet, goopy -- that's a  
24 technical term -- cement-like material, and it comes out of the  
25 hose, and -- as this wet material and sticks to the ceiling.

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1 Q Are the exposures for people involved in spraying the dry  
2 method compared to the wet method different?

3 A No, they're very different.

4 Q How so?

5 A Well, in the dry method this mixing at the nozzle is not a  
6 very efficient process, so as a result, there are many, many  
7 more free, dry fibers that are released to the air.

8 Q Now, in the Reitze article that is in GG-2207, do you have  
9 an understanding of which method he was obtaining industrial  
10 hygiene data on?

11 A Yes, the data that he report relate to the dry type.

12 MR. McMILLAN: Could I have the ELMO, please?

13 Q Dr. Lees, I'm showing you the cover page for a document  
14 that's GX-388, which is a 1982 article by William Nicholson.  
15 Are you familiar with this article?

16 A Yes, this is the study that I referred to several slides  
17 ago.

18 Q The one with the blue and green columns on the chart?

19 A Yes. Yes.

20 Q I'd like to refer you to Page 265 of his article, and  
21 you'll see here that he has a section called, "Construction,  
22 Special Trade Contractors," and within that there's a  
23 highlighted section in which he says, "An investigation of the  
24 spraying of mineral fiber insulation material in New York City  
25 collected on-site samples taken at various distances from the

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1 spraying nozzle. It showed fiber counts ranging from the 70  
2 fibers per mil, 10 feet from the nozzle, to 3 fibers per mil,  
3 25 feet away." And he has a cite there. What is his cite for  
4 this data?

5 A It's the Reitze article.

6 Q So is it your understanding that when Nicholson was  
7 describing the spray fireproofing exposures in his 1982 study,  
8 he was citing to data taken of the dry method?

9 A Yes.

10 Q Now, what kind of spray fireproofing products did W.R.  
11 Grace manufacture?

12 A The wet type.

13 Q As far as you understand, did they only produce spray  
14 fireproofing products that used the wet method of application?

15 A Yes, that's my understanding.

16 MR. McMILLAN: Could I have the -- the other  
17 graphics, please?

18 Q Now, Dr. Lees, we've talked about narrowing down from the  
19 industry to the job to the specific product in use that's going  
20 on, and once you -- say we're using Grace's spray fireproofing  
21 with the wet method. Once you know that that is occurring at a  
22 specific site, is everyone at that site going to have the same  
23 exposure?

24 A No.

25 Q When you're attempting to evaluate exposures in that

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1 circumstance, what do you have to do as an industrial  
2 hygienist?

3 A Well, I need to understand all of the people who would  
4 interact in one way or another with this process of the  
5 application of a spray fireproofing and, therefore, would be  
6 exposed or potentially exposed.

7 Q And once you evaluated the various ways in which those  
8 people were exposed, what would you try and do with them?

9 A You know, what we try to do is to group people into areas  
10 or groups with similar exposures.

11 Q And is that what you attempted to do in this case within  
12 the W.R. Grace data?

13 A Yes.

14 MR. McMILLAN: Show GG-2121.

15 UNIDENTIFIED SPEAKER: Which one was that Scott?

16 MR. McMILLAN: Two one two one.

17 Q Now, Dr. Lees, this is a slide that was shown in opening  
18 about the overall flow of Grace's analysis of claims. Can you  
19 tell us what part of this analysis you worked on?

20 A Okay. I was responsible for what is presented here as  
21 essentially the two left-hand columns. In conducting my  
22 historic exposure reconstruction, I essentially describe the  
23 different products and conditions on which -- under which they  
24 were used and from historic data assigned exposures to those  
25 groups.

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1 Q So you were the one who came up with the occupational  
2 settings into which you were going to group the exposure data?

3 A Yes.

4 Q And then you were the one who produced the eight-hour time  
5 waited average for each of those occupational settings?

6 A Yes, I calculated those. Yes.

7 MR. McMILLAN: Okay. I'd like to go more  
8 specifically into what you did. If we could look at GG-2208?

9 Q Dr. Lees, can you walk us through the steps that you used  
10 to develop those occupational settings and to develop the  
11 average exposures for those occupational settings?

12 A Okay. Very, very simply, it involved, first of all,  
13 identifying all of the products that Grace made and  
14 understanding and developing an understanding of how they were  
15 used.

16 The second step was identifying groups of people who  
17 worked with these products and what they did. And when I said  
18 what they did, I mean how that might influence their exposure  
19 to these products.

20 The third step was to gather all of the historical  
21 exposure data for people working with these products and under  
22 these different conditions. And then given the product, how  
23 it's used, and exposure data, I combined them altogether and --  
24 using a tool called a job exposure matrix, which in reality is  
25 a way of concisely and clearly defining or assigning exposures

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1 by the variables that are important.

2 MR. McMILLAN: Let's start with Step 1 of your  
3 analysis. If we could look at GG-2209?

4 Q How did you identify the Grace products that you were  
5 going to be using in your exposure assessment?

6 A Okay. Well, I have to say that to start off with that in  
7 the early/mid-nineties I worked with Grace and was familiar  
8 with the fire -- the Monokote III fireproofing material. The  
9 -- so I had some preexisting knowledge, and then certainly, I'd  
10 done the work with the vermiculite attic insulation, so I knew  
11 about that. But the first step in the investigation was really  
12 to gather a list of all of the products that Grace had made  
13 over the years that included these substances, and that list  
14 has been produced many times as part of other, you know, legal  
15 actions. And I believe it's even been published in the Federal  
16 Register, so there was a starting list of over a hundred  
17 individual products.

18 Q And once you had that as your starting point, what did you  
19 do to double check it, to add to it, to fill in the blanks, do  
20 that kind of thing?

21 A Okay. Well, that was the list. The next thing I did was  
22 to examine all of the product literature and historic documents  
23 that could be gathered to, first of all, understand how these  
24 materials were used and, you know, reading between the lines,  
25 see if there was anything that had been missed from these

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1 lists. In addition, I consulted depositions of former Grace  
2 employees that talked about these products in some detail.

3 Q Now, once you had gathered all of the available product  
4 information, what did you do with it?

5 A Well, the next step -- and again this is over a hundred  
6 products -- was to group these products into logical groups.  
7 And when I say logical, meaning that they had similar  
8 concentrations or had -- were composed of similar materials.  
9 Let's put it that way.

10 Q Let's look at GG-2210. In the left-hand column with the  
11 green heading are those your product groupings?

12 A That's the -- yes, the product groupings.

13 Q And I see that the first one is labeled vermiculite. What  
14 do you mean by the vermiculite product group?

15 A Well, these products were ones that, in addition to  
16 binders and all this other stuff, contained only vermiculite as  
17 a substance of interest, if you will.

18 Q Why did you think it was important to have a category of  
19 products that just contained vermiculite but no other asbestos  
20 products?

21 A Well, the vermiculite has the potential to be contaminated  
22 with amphibole asbestos, so there's the possibility of an  
23 asbestos exposure associated with just the use of a -- if you  
24 will, a pure or an only vermiculite material.

25 Q And from your work on the vermiculite attic insulation do



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1 you have a sense of the level of the amphibole within  
2 vermiculite?

3 A Yes, my knowledge of that is really just limited to the  
4 samples that were collected and analyzed as a part of my study,  
5 and my recollection is that we're talking usually less than one  
6 percent. You know, tenths of percent typically.

7 Q Now, in the right-hand column you have it labeled use  
8 subcategory. Can you explain to us what the use subcategories  
9 are?

10 A Okay. Well, for a given product it could be used in  
11 different ways that could result in different exposures, and  
12 probably the simplest example of that would be sticking to that  
13 vermiculite category used dry. This would include, among other  
14 things, the installation of attic insulation in which you just  
15 had a bag of vermiculite, and you dumped it out into an attic.  
16 Whereas, there's this -- if you go down a couple, the category  
17 mixed wet and sprayed, in this category vermiculite and some of  
18 these cements and plasters were mixed with water in a cement  
19 mixer and sprayed onto -- as a fireproofing onto steel beams.  
20 Okay? So, clearly, one, you have -- you're dumping dry  
21 materials in a confined space. The other one, you're spraying  
22 a wet material in a -- pretty much an open space, and they have  
23 different levels of exposure associated with those two  
24 different subcategories, if you will.

25 Q So was the purpose of creating use subcategories to try

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1 and group uses that you would expect to have similar exposures?

2 A Exactly right.

3 Q Now, once you had created your product categories and your  
4 use subcategories, what was the next step? I think was going  
5 to be Step 2 in your analysis.

6 A Okay. Well, the next step is really to drill down to the  
7 next level, because within each of these subcategories there  
8 are different occupations that are involved in using these  
9 substances, and they use them in different ways, and they may  
10 have different exposures.

11 MR. McMILLAN: Okay. Can we see GG-2211?

12 Q So in order to determine different occupations or the  
13 different ways in which people might come into contact with one  
14 of those products in a use subcategory, what did you do?

15 A Okay. Well, I relied in part on historic documents, and  
16 in particular, the Grace literature, their advertising  
17 literature, and the literature that they provided to  
18 contractors on how to install our product. That was basically  
19 what they were -- were very useful in describing how people  
20 interacted with the material. You know, also I mean, frankly,  
21 in my youth I worked in the construction industry during  
22 summers, and throughout my professional industrial hygiene  
23 career repeatedly been on construction sites, so you know, I  
24 have some knowledge of how construction happens, if you will.  
25 And I also consulted the published literature.

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1 Q Did you attempt to use any of the PIQ responses, or did  
2 you anticipate using the PIQ responses as a method of  
3 determining how people might have interacted with the Grace  
4 products?

5 A The hope that the onset of my work was that in the  
6 response to the PIQ workers would identify a product and then  
7 identify what their job title was and how they interacted with  
8 the material, if you will.

9 Q What did you find out once the responses came in?

10 A The data were incomplete and, you know, not really very  
11 useful, so I didn't use any PIQ responses in putting these  
12 groupings together.

13 MR. McMILLAN: Can we see GG-2212, please?

14 Q Dr. Lees, on GG-2212 are these the different exposure  
15 categories that you used?

16 A They are.

17 Q Can you tell us briefly what the different exposure  
18 categories are?

19 A Okay. Well, they're listed from A through E, and these  
20 are -- exposure categories involve people who mixed Grace  
21 products, people who cut or removed Grace products, people who  
22 applied Grace products, and the graphics show spraying, but  
23 there are other methods of application. And, in addition,  
24 there were these two other categories, D and E, which were  
25 people who didn't work directly with the Grace product, but

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1 were either in -- on the site where it was being used, in one  
2 of these A, B, C's or in the workspace where active work was  
3 going on.

4 Q How did you differentiate between the people D, who were  
5 on the same site, and people E, who were in the same workspace?

6 A For my purposes I defined the workspace by the walls that  
7 surrounded the workspace, and that's really kind of difficult  
8 and arbitrary sometimes in a construction site, but, for  
9 instance, for a spray application, it would be the floor which  
10 was being sprayed, or if they had tarps up, you know, inside of  
11 the tarps that confined that space. And then the D's would be  
12 everything else.

13 Q Do your exposure categories A through E fairly encompass  
14 the varying ways in which people could be exposed to Grace's  
15 products?

16 A I believe that that is a good summary, yes.

17 Q Is the way in which you grouped workers or exposure groups  
18 similar or typical to the way industrial hygienists normally  
19 create exposure groups?

20 A I think that would be fair to say, yes.

21 Q Okay. Once you had the Grace -- you had the Grace  
22 products categorized, you had the use subcategories, and you  
23 had these different exposure groups within those use  
24 subcategories, what was the next step in your analysis?

25 A Working our way across, the next step was to gather the --

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1 all the available exposure data.

2 MR. McMILLAN: Could we see GG-2214?

3 Q How did you gather the exposure information?

4 A Okay. Well, I -- as I said, I had worked for Grace in the  
5 early nineties and mid-nineties, so I had some of the data  
6 related to the spray-on fireproofing already in my possession,  
7 but I asked -- I requested from counsel the -- all the  
8 available data -- all the available data that they had in their  
9 files relating to their measures of exposure. In addition, I  
10 looked at the literature -- the published literature for  
11 relevant exposure information.

12 Q And in total how many studies were you able to locate that  
13 contained Grace-specific exposure information?

14 A There were approximately 300.

15 Q And how many different data points on Grace-specific  
16 exposures were contained in those studies?

17 A In the end there were approximately 2,000 useable data  
18 points -- exposure measurements contained in those reports.

19 Q Did you also gather any post-construction data points?

20 A Yes, these data came from the literature and encompassed  
21 approximately 16 hundred individual measurements of exposure.

22 Q Okay. Once you had collected all of the available  
23 exposure data on Grace's products, what did you do with that  
24 data?

25 A Well, I did what you normally do with data. I -- you have

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2 whether it's junk.

3 Q Okay, and how did you go about doing that?

4 A The standard procedure is to develop criteria by which you  
5 evaluate data, and then you just work your way through the data  
6 determining whether they -- each individual point conforms with  
7 your A priority criteria or not.

8 MR. McMILLAN: Can we see GG-2215, please?

9 Q Are these the data reliability criteria that you developed  
10 to analyze the Grace data?

11 A Yes.

12 Q Could you give us some examples of the type of reliability  
13 criteria that you used?

14 A Okay. And I should say at the outset that these are  
15 really pretty standard data reliability criteria when it comes  
16 to looking at and evaluating exposure data. But if you look at  
17 the first maybe five bars there, really all relate to did the  
18 study have sufficient identification in terms of who did the  
19 work, when they did the work, and what work was going on with  
20 what product. So that kind of -- that was the first set of  
21 criteria.

22 Q I see about half way down you have a category called,  
23 "Primary Data Collection Only." What did you mean by that?

24 A Within the studies that I received from Grace, there were  
25 two types of studies. One was such as you saw in the previous

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1 slide, you know, field sheets where there's actual raw data  
2 from the field. In addition, there were reports that were kind  
3 of general and just summarized data, so it said that, you know,  
4 the studies last week showed an average of X fibers per cc. It  
5 gave me no information relative to -- you know, no details.  
6 And I think for the most part these were duplicates or  
7 summaries of the field sheets, but since there was not any  
8 specific information or there was not sufficient specific  
9 information, I prefer to use the specific information from the  
10 primary data.

11 Q The last criteria you have up there is, "Data Followed  
12 Accepted Expectations." What did you mean by that?

13 A Again, this would be -- probably you characterize it as  
14 the common sense test, and it was rarely -- very rarely  
15 invoked, and at the moment the only example I can think of was  
16 a situation where in an attempt to measure bystander exposures  
17 they measured concentration -- asbestos concentration upwind  
18 and downwind of an operation. Okay? The upwind concentration  
19 as reported was very, very much higher than the downwind  
20 concentration. Now that -- that doesn't make any sense. Okay.  
21 One would expect the downwind concentration to be higher, so  
22 either that means that they mislabeled the samples, or maybe it  
23 means that somewhere else on the construction site there was  
24 another source of fiber. So, you know, I really didn't know  
25 how to evaluate that particular set of data, so I -- or that --

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1 those two data points, so I didn't use them in my analysis.

2 Q Do you have a sense of the overall proportion of the  
3 studies that you had collected that match all of your data  
4 reliability criteria?

5 A Okay. Well, of those 300 studies I ultimately used about  
6 five -- 250 of them -- I'm sorry -- 250 them in my analyses,  
7 and of the 50 that were eliminated, the vast majority of those  
8 were, because they were summary data that really for the most  
9 part duplicated the primary studies.

10 Q Okay. Once you had the 250 studies that passed your data  
11 reliability criteria, what did you do with that data next?

12 A Well, again, it's similar to what I did in terms of  
13 grouping jobs -- products and jobs. What the next step is to  
14 group the exposure data in similar way.

15 Q Okay. Can you explain to me what you mean by that?

16 A Well, for instance, what I would do would be to -- if you  
17 had the vermiculite installed dry, which that would be people  
18 who installed the vermiculite in attics. So I would gather all  
19 of those data of people who were installing dry vermiculite in  
20 attics and essentially put them all in one bucket. And so I  
21 parsed all the data out into buckets of similar exposures.

22 Q So are you saying that for each of the product categories  
23 you had used were their use subcategories and then the exposure  
24 buckets within that? You transferred all the data into each of  
25 those buckets?



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1 A Yes, that's -- I think that's what I said.

2 Q Sorry.

3 A That's what I tried to say.

4 MR. McMILLAN: Can we see GG-2216?

5 Q Once you had grouped the data by product and use, did you  
6 have to put all the data in the same format or do anything else  
7 to the data?

8 A Well, the individual data, okay, in order to make them  
9 comparable and useful for further analysis, what I needed to do  
10 for each of these individual samples was to calculate the  
11 eight-hour time waited average exposure concentration.

12 Q Is calculating the eight-hour time waited average  
13 something that's standard?

14 A Yes, it's the golden -- it's the standard within  
15 industrial hygiene, yes.

16 Q What about for OSHA compliance? When OSHA demands that an  
17 industry produce sampling data for compliance, how are they  
18 required to be reported?

19 A It's on the basis of eight-hour time waited average  
20 concentration.

21 Q Now, once you've -- when you grouped the data I think you  
22 said within each of these individual exposure buckets for each  
23 kind of product and use, what did you do with the data in each  
24 bucket?

25 A Okay, so in each bucket I have all of the relevant eight-

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1 hour time waited averages. I then averaged all of the data in  
2 that bucket.

3 Q How did you average the data in each bucket?

4 A Well, I used two ways which I characterize as a  
5 unstratified and a stratified method. And, quite simply, the  
6 stratified method was one in which if there were 50 samples in  
7 there, you just average all 50 individual samples. The  
8 stratified method would be that I calculated -- if within these  
9 50 samples there were 25 job sites, I calculated the average  
10 for each job site, and then averaged the averages of the job  
11 sites. So non-stratified is individual samples averages, and  
12 stratified is location or job site averages -- averages of job  
13 site averages.

14 Q Now, when you reported this data in the job exposure  
15 matrix that we're going to get to in a minute, did you report  
16 those averages?

17 A Well, there was one more step in -- before I -- I didn't  
18 use that average. The next step was to adjust those numbers  
19 for the asbestos content of those samples.

20 Q But did you report -- did you report both the PCM average  
21 as well as the PCME average in your job exposure matrix?

22 MR. WEHNER: Objection. Foundation and hearsay.

23 THE COURT: I don't think there's a foundation yet  
24 for that question.

25 Q Did you prepare a job exposure matrix to summarize the

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1 results of your analysis and the data that you had collected?

2 A Yes.

3 Q And did you report the average for each of the exposure  
4 buckets in that job exposure matrix?

5 A Yes.

6 Q And when you reported that average in the job exposure  
7 matrix, did you report both the PCM average and the PCME  
8 average?

9 A Yes.

10 THE COURT: Do you want to tell me what those are?

11 MR. McMILLAN: Yes, I'm about to get there.

12 Q Why did you report the average?

13 A Okay. Well, the average is the metric that is used to  
14 calculate the cumulative exposure or sometimes called dose,  
15 which is the input to risk assessment or to epidemiologic  
16 studies.

17 MR. McMILLAN: Can we see GG-2217?

18 Q Now, when EPA uses exposure data for its risk assessments,  
19 what does the EP -- what data point does the EPA use?

20 A They use the average.

21 Q Now, if you look at GG-2217, you'll see on the left an  
22 excerpt from the EPA 1992 supplement RAGS Guidance. What is  
23 the RAGS Guidance?

24 A RAGS stands for risk assessment guidance for superfund.

25 Okay? And what it is essentially is EPA's textbook on how to

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1 do a risk assessment.

2 Q And in EPA's textbook for how to conduct a risk  
3 assessment, what does it say you should use? What exposure  
4 data should you use in that risk assessment?

5 A It says the average concentration is the most  
6 representative of the concentration that would be contacted  
7 over time.

8 Q Now, if you look on the right-hand side of GG-2217, you'll  
9 see an excerpt from the EPA 1986 Airborne Asbestos Health  
10 Assessment Update. What is that document?

11 A This is EPA's big risk assessment of the public health or  
12 the possible public health implications of exposure to  
13 asbestos.

14 Q So when the EPA was calculating the risks to public health  
15 from asbestos, what was the exposure data they were using?

16 A They used the average.

17 Q Dr. Lees, have you conducted exposure assessments  
18 previously for epidemiologic studies or risk assessments?

19 A Yes.

20 Q And have some of those been published in the peer-reviewed  
21 literature?

22 A Yes, on that -- we spoke earlier on my chromium study  
23 that's been published.

24 Q And when you have reported exposure data within those  
25 peer-reviewed articles, how did you report that exposure data?

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1 A When it was to be used for an epidemiologic study, I  
2 reported the average exposure.

3 MR. McMILLAN: Could I have the ELMO for a moment,  
4 please?

5 Q Dr. Lees, I'm showing you what has been marked as GX-628.  
6 Do you recognize this?

7 A Yes. That's a paper that I published in the early 1990's.

8 Q And is this an epidemiologic study, or was this a  
9 characterization of exposure data for use in epidemiologic  
10 studies?

11 A It was a characterization of exposure data used in many  
12 epidemiologic studies of chromium and disease, yes.

13 Q And this was published in the peer reviewed literature?

14 A As I remember, it was environmental health perspectives.

15 Q I'd like to have you turn -- or you can look at Page 94  
16 with me, please. And you'll see at the bottom you have a  
17 statement that says, "Historically, most air sampling in  
18 industrial facilities was conducted in an effort to solve a  
19 problem. As such, much historic air sampling may overestimate  
20 average exposures (required for epidemiologic risk assessment)  
21 considerably." Can you explain to us what you meant by that?

22 A Sure. Sure. Historically, and I include the early part  
23 of my career in history, unfortunately, but industrial  
24 hygienists are problem solvers, so we go and we look for  
25 problems that need to be fixed. And so, we make our

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1 measurements where we think there may be a problem. So that  
2 there's a historic bias to -- if we would go out to a work  
3 site, we would only collect a sample during the time period in  
4 which people were actively working. We don't collect samples  
5 when the equipment is broken down, or when they're on coffee  
6 break, or something like that. So, historic data are --  
7 reflect not the average over the course of a day, but the  
8 exposure during times of actual work.

9 Q So, if you're doing a historic exposure reconstruction and  
10 you are using the historic data as the average of all  
11 exposures, are you more likely to overestimate or underestimate  
12 the actual average exposure?

13 A Well, if it were collected as I described there, it would  
14 be an overestimation of the overall average exposure.

15 Q I'd like to turn to Page 95 of your study. And focusing  
16 in on Table 1, could you please tell us briefly what is Table  
17 1?

18 A Table 1 is a part of that -- my published article, and  
19 this is taken from Painesville, Ohio. That would be the  
20 Mancuso article on risk of lung cancer related exposure to  
21 hexavalent chromium.

22 MR. WEHNER: Objection. Relevance. This is about  
23 chromium.

24 MR. McMILLAN: Your Honor, I am trying to show that  
25 in other published peer reviewed literature in which Dr. Lees

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1 has presented exposure data for an epidemiologic study he has  
2 reported the average without any indicators of variability, and  
3 that is what this goes to.

4 THE COURT: All right. To that end it's relevant.  
5 It's admitted for that purpose only.

6 Q Dr. Lees, does Table 1 present the exposure data, or some  
7 of the exposure data that was part of your published article  
8 that is GX-628?

9 A Yes.

10 Q And when you reported this exposure data in GX-628, how  
11 did you report that data?

12 A Well, these were actually Mancuso, the way Mancuso  
13 reported it, as averages.

14 Q And was there any standard deviation, or competence  
15 interval reported with the data?

16 A No, there was not.

17 Q Dr. Lees, I'm showing you what has been labeled GX-629.  
18 Do you recognize this article?

19 A Yes. This is an article that was published, I think, in  
20 2000, summarizing the chromium study that I conducted that we  
21 discussed earlier.

22 Q And was this published in the peer reviewed literature?

23 A Yes, it was. I believe it's the American Journal of  
24 Industrial Medicine.

25 Q And you're one of the authors of this study?

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1 A That is correct.

2 Q And if you look at the highlighted language on the first  
3 page, can you read that for us?

4 A It's difficult. It says, "Annual average --" Whoa.

5 Q Sorry.

6 Q "Annual average exposure estimates based on historical  
7 exposure measurements were made for each job title in the plant  
8 for the years 1950 through 1985."

9 Q So, when you --

10 MR. WEHNER: Objection, Your Honor. He is impeaching  
11 his own witness, and leading.

12 THE COURT: I don't think this is impeachment. It's  
13 -- but it is getting pretty far afield from what on earth is  
14 going on with respect to asbestos.

15 MR. McMILLAN: Understood, Your Honor. We'll move  
16 on. Could we see GG-2218, please?

17 Q Dr. Lees, I think you said earlier that the average is the  
18 most appropriate accurate measure of long term exposure. Is  
19 that right?

20 A That is correct.

21 Q Why is that the case?

22 A Well, occupational exposures vary. There's variability in  
23 -- for a worker. They're not exposed to the same level, the  
24 same concentration every day. One day it may be high, one day  
25 it may be lower, the next higher or lower. And -- but over

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1 time, these highs and lows balance each other out, and so, over  
2 the long term the best estimator of exposure is the average.

3 Q When you're talking about asbestos, asbestos exposures,  
4 what are the sources of variability in the measurement of  
5 asbestos exposures?

6 A Well, asbestos, or any exposure assessment, the  
7 variability is due primarily to three factors. First of all,  
8 there's variability due to the analytical method. Second of  
9 all, there would be variability due to interworker effects, if  
10 you will. And finally, environmental variability plays into  
11 this overall variability.

12 Q Can you give me an example of analytical variability?

13 A Well, in the case of asbestos, you could have -- and which  
14 I said earlier, concentration is -- the analysis involves  
15 counting fibers under a microscope. And one analyst might  
16 count 22 fibers, where another analyst would count 20 fibers.  
17 Okay? So, that's an error in variability associated with  
18 measurement.

19 Q Is analytic variability something that's random, or does  
20 it have a direction one way or the other?

21 A It's random. It's up, down. It is totally random.

22 Q Can you give me an example of interworker variability?

23 A Okay. Well, interworker variability, again, these are  
24 things that -- differences between workers that may affect  
25 exposure. And some examples might be whether somebody was

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1 right-handed or left-handed, or they were tall or short, or  
2 whether they were experienced or inexperienced in a job.

3 Q Now, would interworker variability be something that is  
4 random, or could there be a direction to that error?

5 A There could be a direction, which we'd call a bias. For  
6 instance, there may be some reason that right-handed workers in  
7 a particular process are exposed at higher levels  
8 systematically than left-handed workers.

9 Q Now, lastly, environmental variability. Can you give me  
10 an example of environmental variability?

11 A Okay. Well, environmental variability is particularly  
12 important in the construction trades, which are -- take place  
13 in an uncontrolled environment, unlike a factory. And so,  
14 these might involve things such as -- well, let's take spraying  
15 as an example, spraying fireproofing, you know, how high the  
16 ceiling is, whether there were tarps up, whether the wind was  
17 blowing, what direction the wind was blowing, how hard the wind  
18 was blowing. All of these things would go to -- to change, or  
19 effect the measurement of exposure.

20 Q Now, which of these types of variabilities have the  
21 strongest effect on asbestos exposures?

22 A Oh. Far and away, asbestos or any other exposure, the  
23 environmental -- the random environmental variability has the  
24 most effect on, you know, the overall variability.

25 Q How do you know that?

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1 A As I said at the beginning, industrial hygienists seek to  
2 understand exposures and what influences exposures, so this has  
3 been studied many, many times, and the literature, you know,  
4 says what I just said.

5 Q In the course of your work on over 100 different exposure  
6 assessments, have you looked at the issue of what are the --  
7 or, the magnitude of the various sources of data variability?

8 A I think my own observations would bear out what I just  
9 said, and what the literature says.

10 Q So, if environmental variability -- well, let me ask one  
11 more question. Is environmental variability something that's  
12 random, or something that has a systematic bias to it?

13 A It is random.

14 Q So, if environmental variability is random, and it's the  
15 main source of variability, what does that mean to individual  
16 exposures over the long term of years to tens of years?

17 A That means that since this variability is random, the ones  
18 that are higher and the ones that are lower tend to balance  
19 out, and focus or center on an average value. In addition,  
20 over time the average of an individual and the average of the  
21 entire population will converge upon each other.

22 Q Is that why it's appropriate when using industrial hygiene  
23 data in an epidemiologic study to use the average, or to report  
24 the average?

25 A Exactly.

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1 MR. RASMUSSEN: I object, and move that that answer  
2 be struck. It's a leading question on a key issue without the  
3 proper foundation.

4 THE COURT: Well, it's a leading question, but there  
5 is a foundation. Restate the question, please.

6 Q Why is it appropriate in the long term to use the average  
7 exposure for epidemiologic studies?

8 A Because it best represents the long term exposure.

9 Q Dr. Lees, once you have -- you now have the average  
10 exposure within each of your different exposure buckets. Are  
11 you done at that point?

12 A No. There's still at least one more step here.

13 MR. McMILLAN: Can we go to GG-2220? 22 -- 2219.

14 Q What's the next step that you need to take with the data  
15 after you have the average?

16 A Okay. The data that were used and processed or analyzed  
17 were collected -- the exposure data were collected using phase  
18 contrast microscopy, which is an analytical method that  
19 identifies all fibers without respect to its composition. And  
20 it's well known that within the construction environment that  
21 there are mixed fibers, that is, asbestos and non-asbestos  
22 fibers. So, the next step was to make an adjustment so that we  
23 -- the -- expressed the exposure concentrations as purely the  
24 asbestos fiber concentrations.

25 Q Can we back up and can you tell us briefly what is phase

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